



## Bird Mashups -

Using Google Earth & NASA's World Wind to Map Bird Migration



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# Google Earth & World Wind Mashups

## Bird Migration Research

- Dixon Field Station
- Long history of bird migration research since 1977
- Radio & satellite telemetry
- Many species of birds



Releasing a snow goose



Band-tailed Pigeon



Swan goose



Female pintail duck with transmitter



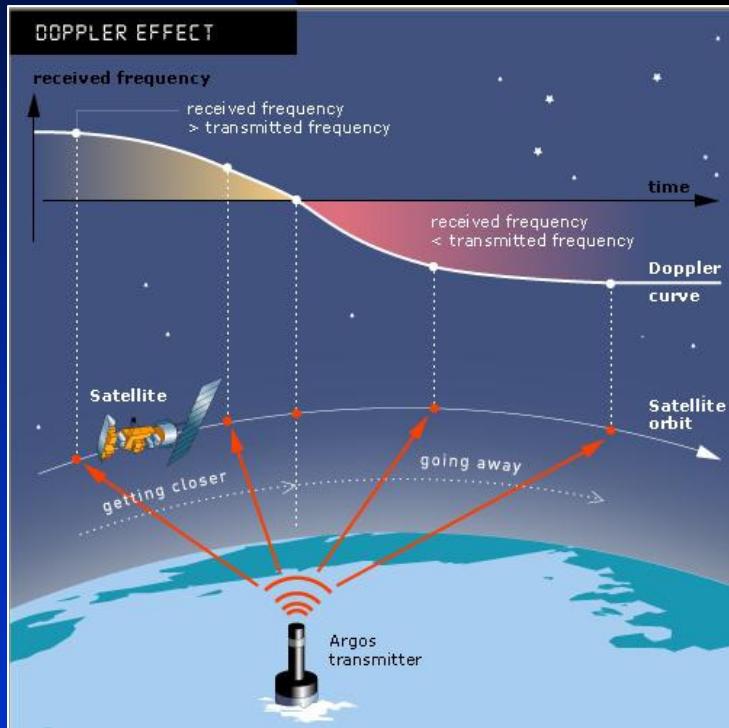
Male surf scoter

# Google Earth & World Wind Mashups

## Tracking Birds using Satellite Telemetry

- PTT (platform transmitter terminal)
- Two technologies –

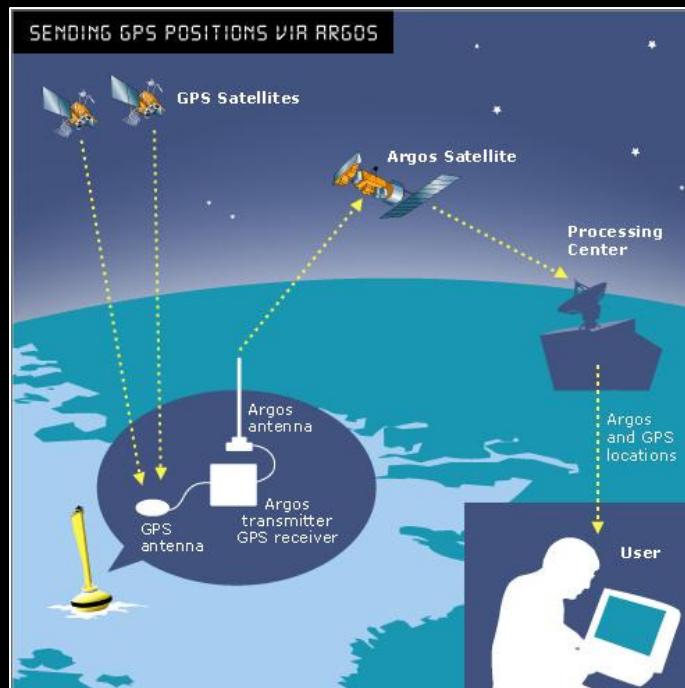
Argos



The Argos centers calculate PTT location based on Doppler shift on its transmitted frequency.



GPS



The Argos center extracts GPS positions from the Argos messages

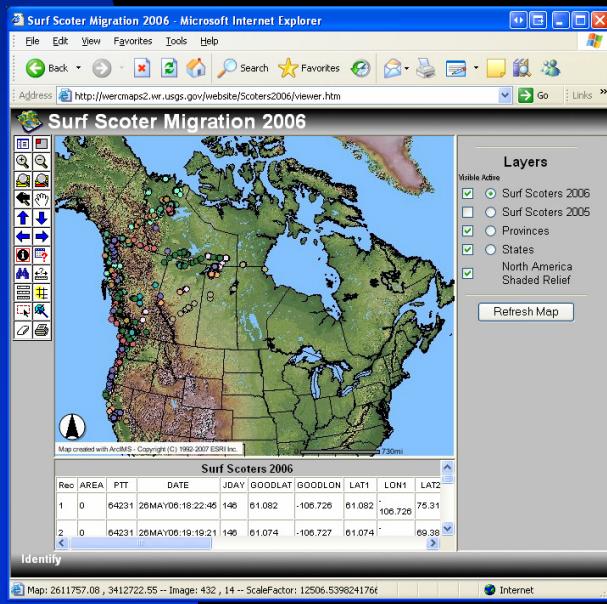


# Google Earth & World Wind Mashups

The old way to make maps....

- Data received via email
- Manually saved and copied to UNIX server
- Run SAS filtering algorithm
- Coverages and E00 files created
- Point & line data imported
- Static maps in ArcView/ArcGIS
- Interactive maps in ArcIMS

Interactive Maps

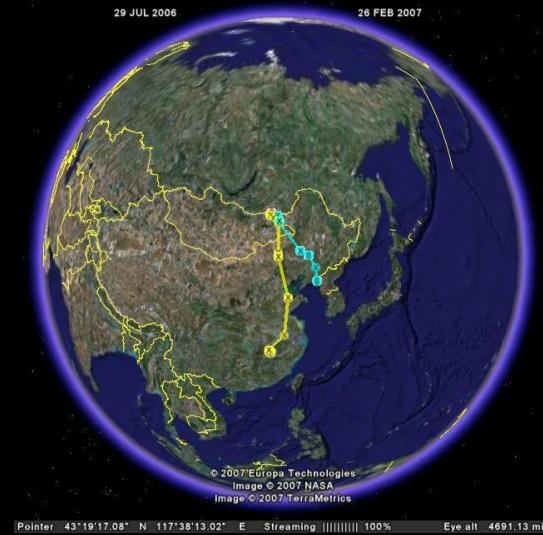


Static Maps

# Google Earth & World Wind Mashups

The new way ....How does it work?

- Telnet data from Argos
- Run SAS filtering algorithms
- Create Google Earth & World Wind files
- Create & email synopsis files
- Upload kmz files to USGS Enterprise FTP web site.
- Automate process using Windows Scheduler



# Google Earth & World Wind Mashups

Why use Google Earth/World Wind?

- International study sites – not always good base maps
- Good way to automate map making
- Easy way to distribute your data
- They're cool!



# Google Earth & World Wind Mashups

How does it work?

The secret is in the SAS code....

Create kml files – 1100+ lines of code

```
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://earth.google.com/kml/2.0">
<Folder>
<name>GG07_73002_Points:_both_r100d10lc1</name>
<visibility>0</visibility>
<open>0</open>
<description><![CDATA[Locations Coded by Argos Location Quality, Click Location for More Info]]></description>
<Placemark>
<name>2/14/07:0</name>
<description>Animal: GG07_73002 <br/>.
. PTT: 73002 <br/>.
. Date/Time: 2/14/07:01:0<br/>.
. Location Class: DF <br/>.
. Dist From Previous Loc: 0.00 km<br/>.
. Rate From Previous Loc: 0.0 km/hr<br/>.
. Azimuth From Previous Loc: 999<br/>.
. Hours Since Previous Loc: 0.00<br/>.
. Days Since Previous Loc: 0.00<br/>.
. Days Since Deployment: 0<br/>.
. Both Test Criteria: MWD-ANCHOR <br/>.
. Line: GG07_7300220070214:0001000DP <br/>.
. <br/> Location from Filtered Dataset:<br/>.
. both_r100d10lc1.
</description>
<Lookat>
<longitude>-4.3</longitude>
<latitude>15.22</latitude>
<range>100000.0</range>
<tilt>0.0</tilt>
<heading>0.0</heading>
</Lookat>
<TimeStamp>2007-02-14T00:01:00Z</when></TimeStamp>.
<styleId>#8&#8226;652</styleId>.
<Style>
<labelStyle>
<color>ff9afaf0</color>
<colorMode>normal</colorMode>
<scale>1</scale>.
</labelStyle>.
<iconStyle>.

```

World Wind files – 550+ lines of code

```
*****.
* Install World Wind 1.3.5 Point and Vector Graphic Overlays.
* Requires World Wind to be previously installed.
* David Douglas, USGS Alaska Science Center, Aug 2006
*****.
* Macro for writing the WW XML Point header and Vector Layer
macro pthead;
.
array wincolor(0:24) $ 20 ;
%include &ww_colors.;
.
set one end=last;
retain count ncolor narray dateann;
if _n_ = 1 then do; count = 0; nlocs = 0; end;
by animal;
.
fname = "&ww_root.\Config\Earth\" || trim(left(put(animal,$25.)))||"_efiltsuf._rminrate.dmaxredun.lc&keep_lc.
file each_xml filervar=fname;
.
if first.animal then do;
ncolor = 0;
narray = count - (int(count/25)*25);
layername = trim(left(put(animal,$25.)))||"_efiltsuf._rminrate.dmaxredun.lc&keep_lc.";
put <xml version="1.0" encoding="utf-8" standalone="yes">;
if &ww_top_animal. = 0 then
put "<LayerSet Name=""layername"" ShowOnlyOnLayer="false" ShowAtStartup="false" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">.
put "<LayerSet Name=""layername"" ShowOnlyOnLayer="false" ShowAtStartup="true" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">.
if &ww_all_vector. = 0 then
put "<PathList ShowAtStartup="false">.
if &ww_all_vector. = 1 then
put "<PathList ShowAtStartup="true">.
put tab '<Name>Vectors</Name>'.
put tab '<DistanceAboveSurface>50</DistanceAboveSurface>'.
put tab '<MinDisplayAltitude>0</MinDisplayAltitude>'.
put tab '<MaxDisplayAltitude>95000000</MaxDisplayAltitude>'.

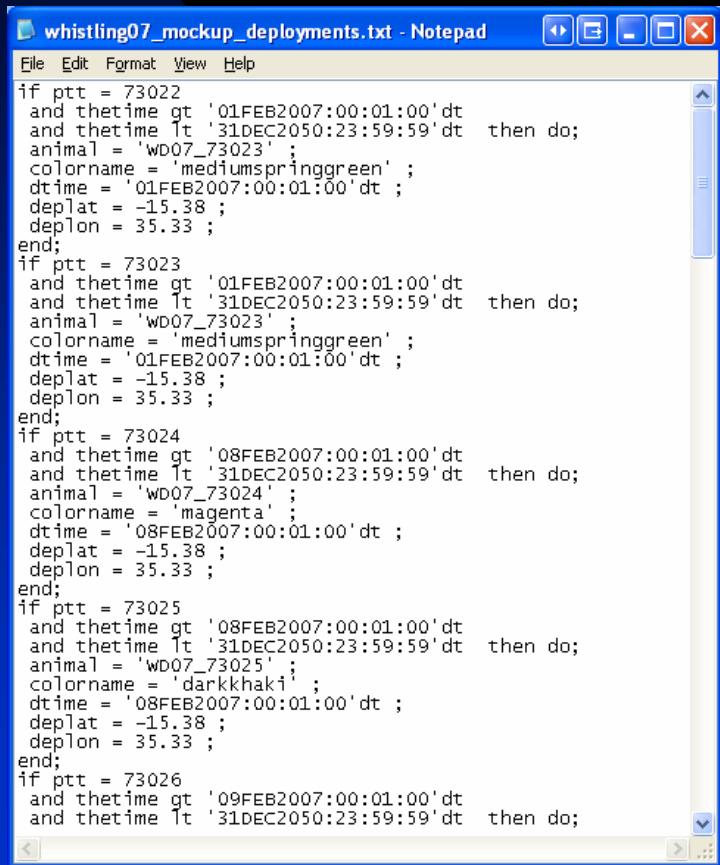
```



# Google Earth & World Wind Mashups

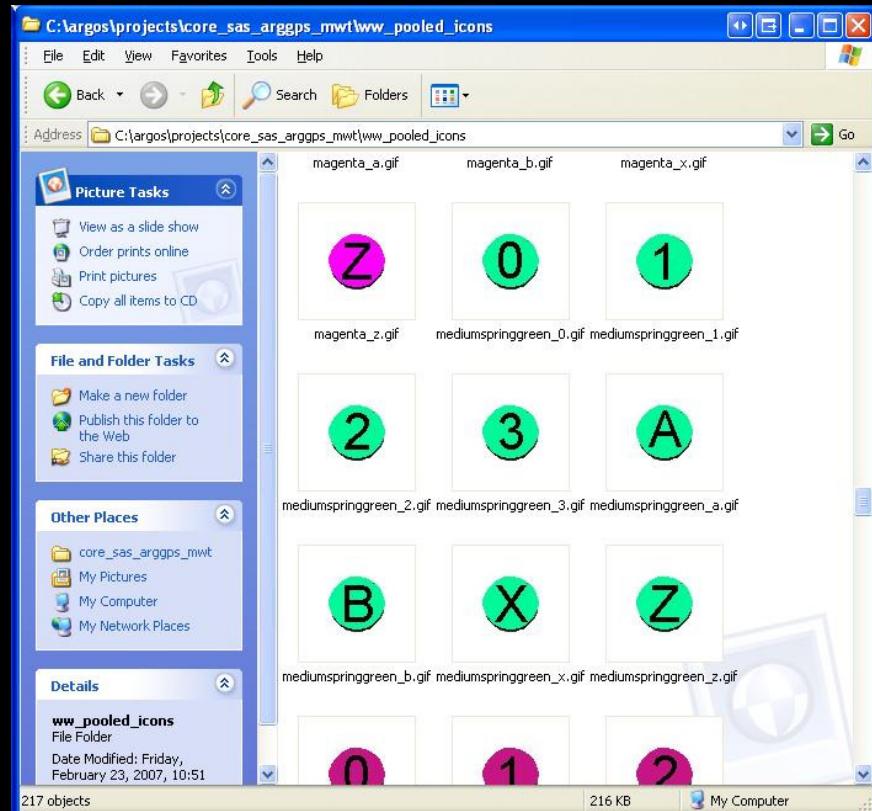
How does it work?

Deployment file



```
whistling07_mockup_deployments.txt - Notepad
File Edit Format View Help
if ptt = 73022
and thetime gt '01FEB2007:00:01:00'dt
and thetime lt '31DEC2050:23:59:59'dt then do;
animal = 'wd07_73023';
colorname = 'mediumspringgreen';
dtime = '01FEB2007:00:01:00'dt ;
deplat = -15.38 ;
deplon = 35.33 ;
end;
if ptt = 73023
and thetime gt '01FEB2007:00:01:00'dt
and thetime lt '31DEC2050:23:59:59'dt then do;
animal = 'wd07_73023';
colorname = 'mediumspringgreen';
dtime = '01FEB2007:00:01:00'dt ;
deplat = -15.38 ;
deplon = 35.33 ;
end;
if ptt = 73024
and thetime gt '08FEB2007:00:01:00'dt
and thetime lt '31DEC2050:23:59:59'dt then do;
animal = 'wd07_73024';
colorname = 'magenta';
dtime = '08FEB2007:00:01:00'dt ;
deplat = -15.38 ;
deplon = 35.33 ;
end;
if ptt = 73025
and thetime gt '08FEB2007:00:01:00'dt
and thetime lt '31DEC2050:23:59:59'dt then do;
animal = 'wd07_73025';
colorname = 'darkkhaki';
dtime = '08FEB2007:00:01:00'dt ;
deplat = -15.38 ;
deplon = 35.33 ;
end;
if ptt = 73026
and thetime gt '09FEB2007:00:01:00'dt
and thetime lt '31DEC2050:23:59:59'dt then do;
```

Map icons



# Google Earth & World Wind Mashups

## Synopsis file

X = most recent (in past day\_intervals) Message and Argos Location 37  
19:25 Monday, February 26, 2007

animal ptt M\_24h L\_24h M0\_1 L0\_1 M2\_3 L2\_3 M4\_7 L4\_7 M8\_15 L8\_15 M\_g15 L\_g15

WD07_73023	73023		X	X
WD07_73024	73024	X X X X		
WD07_73025	73025		X X	←
WD07_73026	73026	X X X X		
WD07_73027	73027	X X X X		
WD07_73028	73028		X X	
WD07_73029	73029	X X X X		
WD07_73030	73030	X X X X		
WD07_73033	73033	X X X X		
WD07_73287	73287	X X X X		
WD07_73291	73291	X X X X		
WD07_73292	73292		X X	
WD07_73293	73293		X X	
.	.			

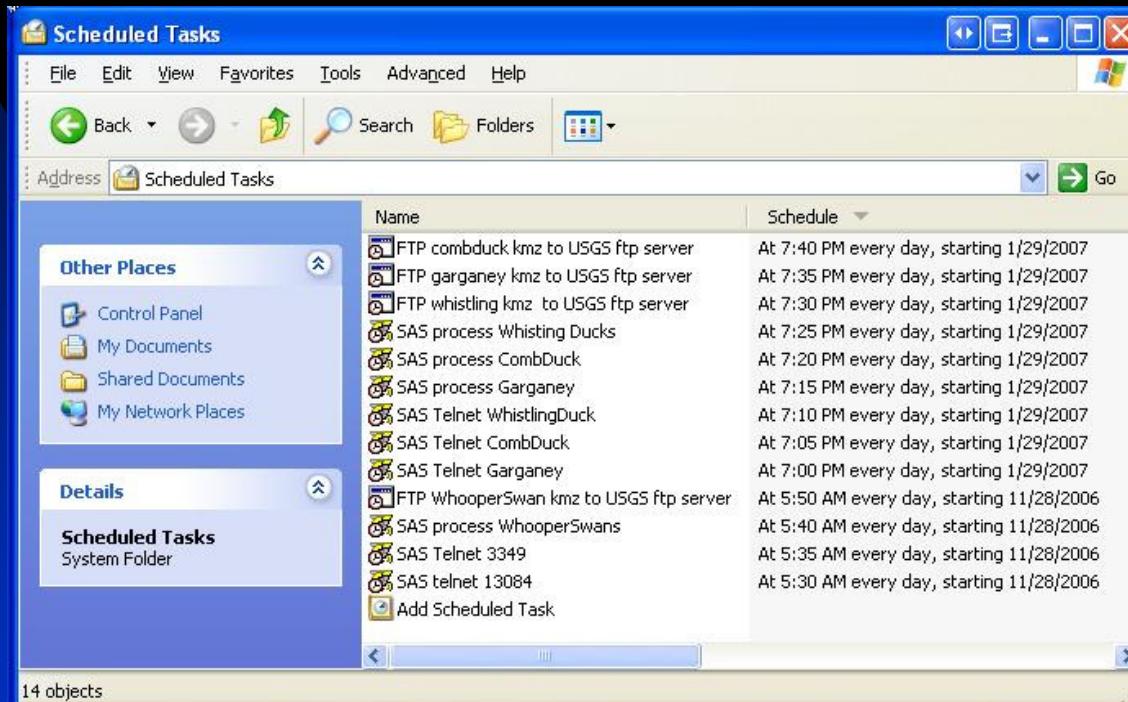
The most recent Argos downloads and processed KMZ files are listed below to verify that file date-times are current.

.  
02/26/2007 07:10 PM 37,780 diag\_25349\_7058-55.txt  
02/26/2007 07:10 PM 59,615 disp\_25349\_7058-55.txt  
02/26/2007 07:25 PM 90,997 all\_whistling07.kmz  
02/26/2007 07:25 PM 69,084 daily\_whistling07.kmz



# Google Earth & World Wind Mashups

Automate tasks



# Google Earth & World Wind Mashups

Google Earth vs. World Wind - which one?

## Google Earth

- Popular and well known
- Easy to use
- Easy to distribute data (kml/kmz)

## World Wind

- Not as well known, but many user authored add-ons & plug-ins
- Open source
- Scientific Visualization tools
- Additional data available (weather patterns, fires)
- Can turn imagery layers on and off
- Sometimes gives clearer image

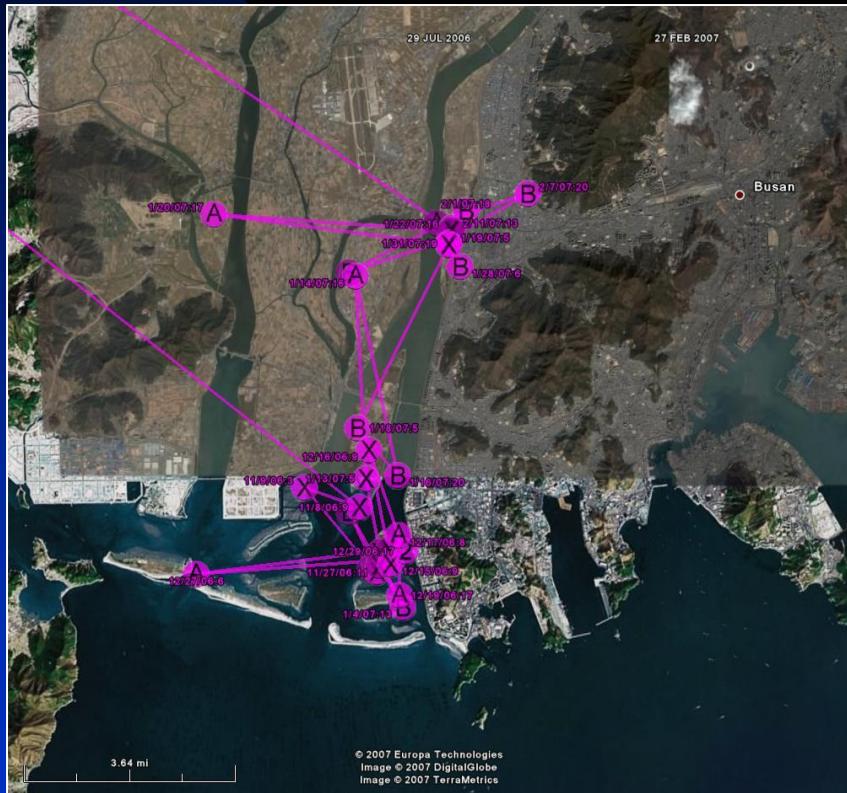
Answer, use both!



[http://www.worldwindcentral.com/wiki/Google\\_Earth\\_comparison](http://www.worldwindcentral.com/wiki/Google_Earth_comparison)

# Google Earth & World Wind Mashups

Google Earth vs. World Wind - which one?



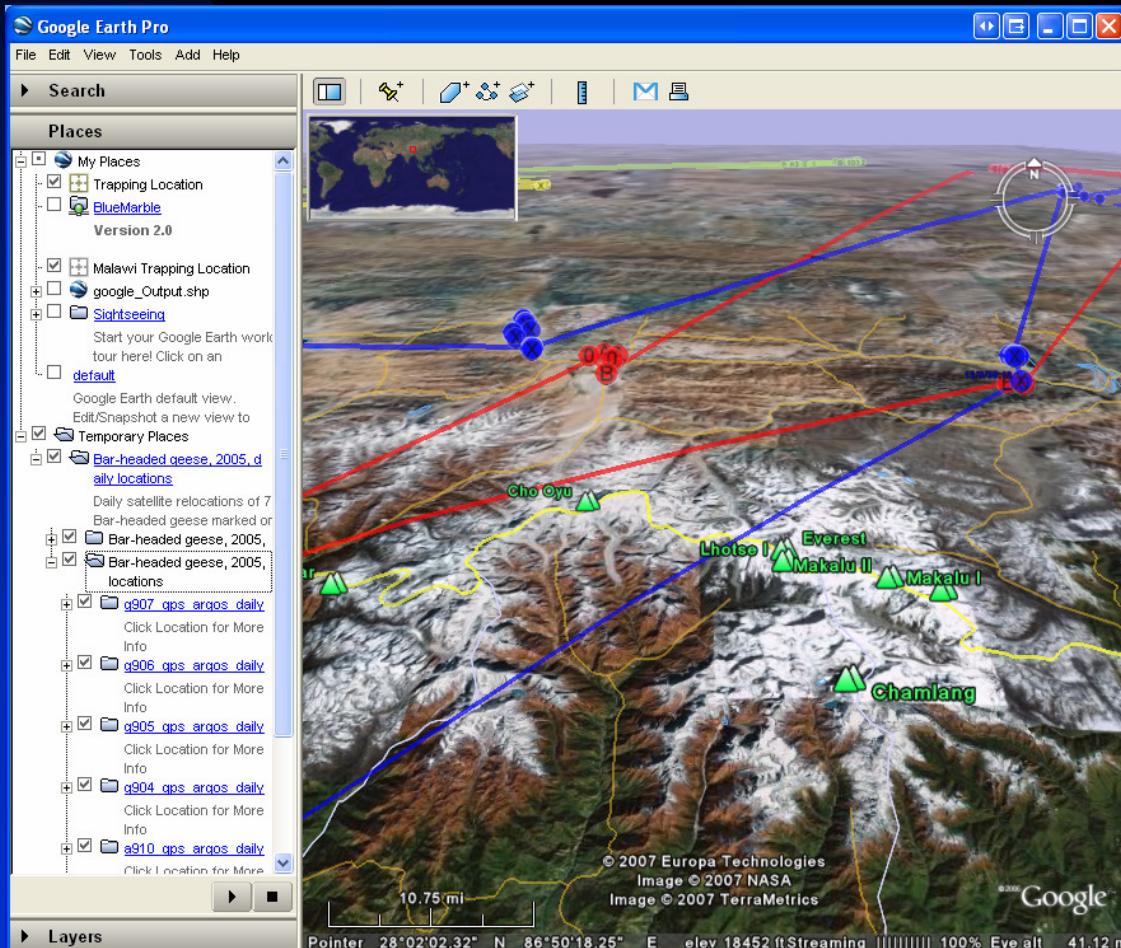
Google Earth



World Wind

# Google Earth & World Wind Mashups

## Bar-headed geese in Nepal

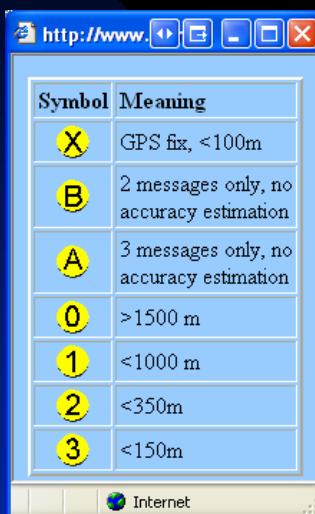


Bar-headed goose with transmitter in Nepal

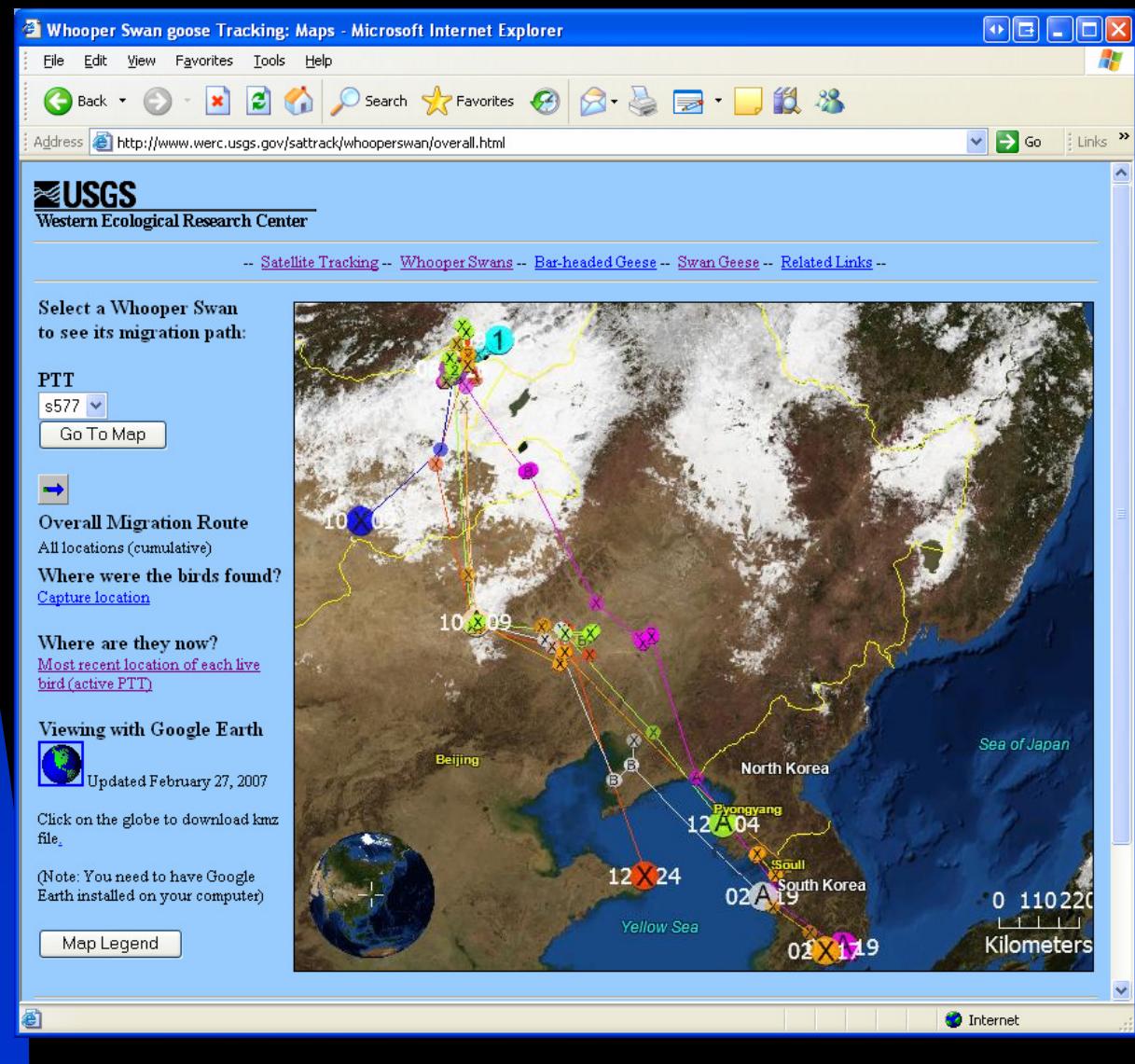


# Google Earth & World Wind Mashups

## Swan Geese and Whooper Swans in Mongolia

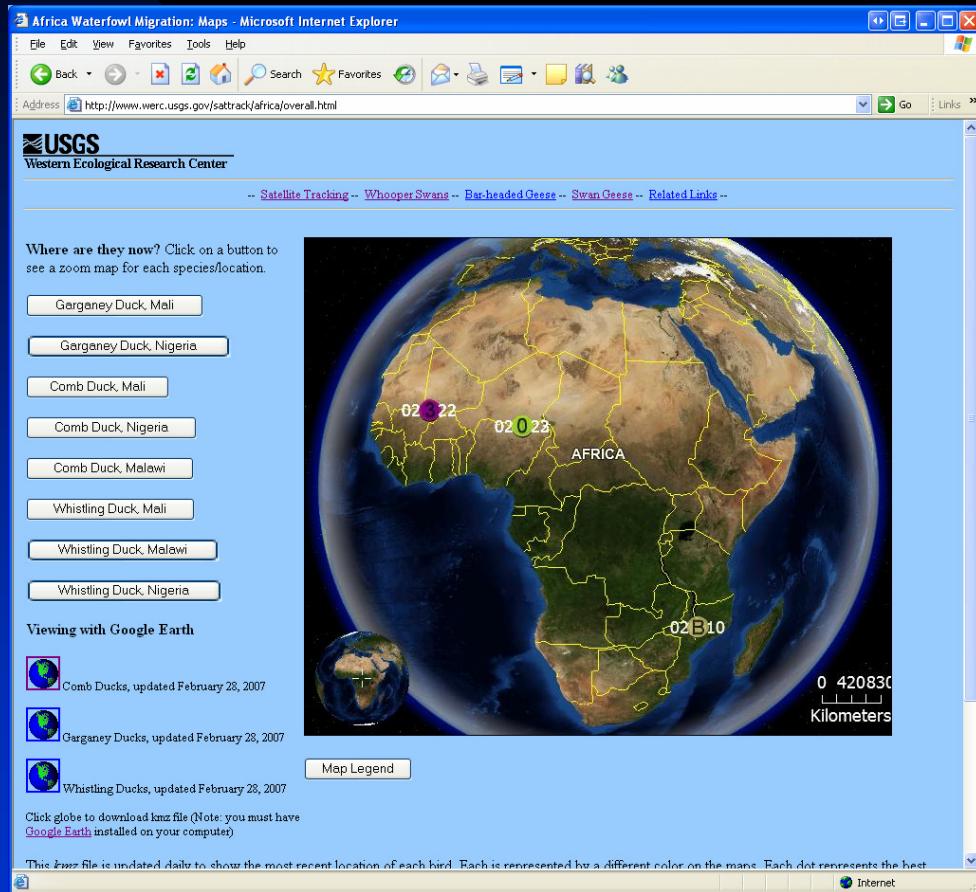


Whooper swan



# Google Earth & World Wind Mashups

## Comb, Garganey and White-Faced Whistling Ducks in Africa



Garganey duck



White-faced whistling duck



Male comb duck



# Google Earth & World Wind Mashups

## Bar tailed Godwits in New Zealand



Bar tailed Godwit

Shorebird Migration - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address http://www.werc.usgs.gov/satrack/shorebirds/overall.html

USGS science for a changing world

Pacific Shorebird Migration Project Webpage hosted by the Western Ecological Research Center

Where are they now?

Map of Godwit Locations

North capture site

South capture site

Viewing with Google Earth

Godwits, updated February 27, 2007

Click globe to download kmz file. (Note: you must have Google Earth installed on your computer to view this data).

This kmz file is updated daily to show the most recent locations of the Bar-tailed Godwits marked in New Zealand in February 2007. Each of the 16 godwits is represented by a different color on the maps. Each dot represents the best location for a particular bird during the time periods that the satellite transmitter was turned on. Right now, the transmitters are reporting either every 2 days or every 5 days depending on how they were programmed. The numbers on the dots refer to the accuracy of the locations (see legend). Please note that these locations are preliminary because the data has yet to be fully processed and analyzed. This means that many locations and track speeds will be somewhat different in the final analysis.

Map Legend

AUCKLAND

WELLINGTON

CHRISTCHURCH

DUNEDIN

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Accessibility FOIA Privacy Policies and Notices

U.S. Department of the Interior | U.S. Geological Survey

URL: http://www.werc.usgs.gov/shorebirds/index.html

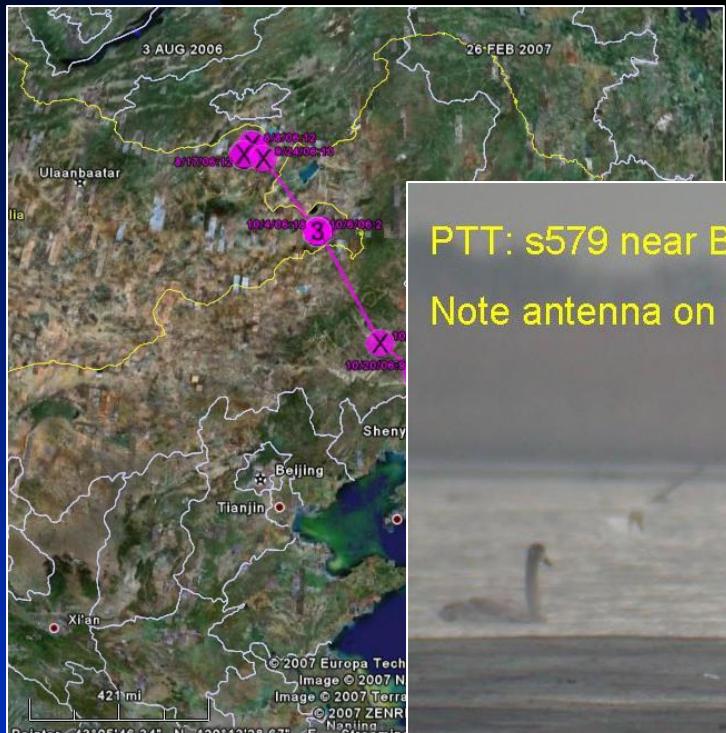
USA.gov

Internet

A screenshot of a Microsoft Internet Explorer window displaying a map of New Zealand. The map shows the locations of tracked Bar-tailed Godwits, indicated by colored dots numbered 1 and 2. Dot 1 is near Auckland, and dot 2 is near Wellington. The map also labels major cities: Auckland, Wellington, Christchurch, and Dunedin. The window includes the USGS logo and navigation links for the Pacific Shorebird Migration Project.

# Google Earth & World Wind Mashups

One Benefit of making data available.... Bird Discovery!



PTT: s579 near Busan, Korea.  
Note antenna on transmitter



# Google Earth & World Wind Mashups

## Next Steps:

- More enhancements to Google Earth - legends
- Explore methods to automate static maps – GMT (Generic Mapping Tool)

For more Information:

Satellite Tracking Migratory Birds website  
<http://www.werc.usgs.gov/sattrack/index.html>

